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Comparative characteristics of the facial skull size of an adult, depending on the shape of the nose

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The craniometrical indicators of the facial skull were studied in 40 specially selected human skulls from the craniological collection of the fundamental museum of the human anatomy department of the Azerbaijan Medical University. It was established that among the studied skulls, mesoproseps prevail in the shape of the facial skull, and leptorrhines in the shape of the nose. In the female series, a significant asymmetry was determined by the nazion-zygomaxillary indicator for chamerins left-sided, for leptorrhines right-sided, whereas in the mezorin group the asymmetry was right-sided and insignificant. A steady trend towards left-sided asymmetry was found in almost all indicators of the "side fan" in the men's series. The only exception was the distance from the point of the zygomaxillary to the lowest point of the pear-shaped hole, along which the right-sided asymmetry was noted in the male series.

Keywords: *Asymmetry, facial skull, fan morphometry method, superscript face*

INTRODUCTION

Asymmetry of the face - an important factor in the individuality of beauty. According to the literature, it can be noted that the asymmetry of the face is caused by changes in the soft tissues, facial vessels, muscles, including changes in the bones of the skull, but if there are many articles devoted to soft tissue structures and a range of diagnostic and therapeutic manipulations is directed to them, then the bone structure is not studied so far.

If a lot of scientific papers are devoted to soft tissue structures (Ponomareva, 2010; Hwang et al., 2012; Nur et al., 2014; Starbuck et al., 2016), the asymmetry of the bone structures on different forms of the skull, especially in the sexual aspect, has been little studied (Nikolayeva, 2007; Zhang et al., 2013). It should be noted that among the diversity of the bony structures of the facial skull and its formations, the external nose occupies a central place as the most cosmetically and aesthetically important formation, the shape and size of which determine not only the beauty of the human face, but are paramount in the formation of facial asymmetry (Khrappo and Tarasova, 1999; Gayvoronsky et al., 2009).

The aim of the work was to study the size of the facial skull in an adult, depending on the shape of the nose.

MATERIALS AND METHODS

Individual and gender differences in craniometrical indices of the facial skull were studied on 40 specially selected human turtles from the craniological collection of the fundamental museum of the human anatomy department of the Azerbaijan Medical University.

To realize this goal, a comprehensive study was conducted. The essence of which lies not only in the measurement of the morphometric parameters of the facial skull, but also in the assessment of the size between standard and non-standard points by the original method.

The measurements were carried out according to the method of R. Martin in compliance with the existing craniometrical requirements used in anthropological research (Martin, 1928). For the measurement of the relevant parameters, thickening, coordinate, and sliding compasses were used, as well as a soft flexible ruler. The measurement accuracy reached 0.5 mm. The work

mainly used standard craniometrical points, some of which are used in clinical practice.

The following dimensions of the facial skull and nasal area are measured:

1. Upper face width - the distance between the points of the fronto-molar-temporal (between the outermost points of the frontal-zygomatic suture);
2. Zygomatic diameter - the greatest distance between the outer surfaces of the zygomatic arches;
3. The upper height of the face - the distance between the nasion point and the alveolar point - the lowest point of the upper jaw alveolar edge between the medial incisors;
4. Dacrial width - the distance between the points of the orbit (dacrion), located at the junction of the frontal and lachrymal bones with the frontal process of the upper jaw;
5. The upper front pointer;
6. Nose width - the greatest distance between the outer edges of the pear-shaped hole;
7. Nasal index - the ratio of the zygomatic width to the upper height of the face expressed as a percentage.

According to the nasal index, the studied skulls were divided into 3 groups (Martin, 1928):

1. Leptorrhines (narrow nose) (ind. nose <43.5 - 47.5);

2. Mezorins (average width of the nose) (ind. nose 47.6 - 52.1);

3. Chamerins (wide nose) (ind. nose> 52.2).

The characteristic of the group of skulls that we study was carried out on the basis of the upper index of the face. The upper index of the face is the ratio of the upper height of the face (the distance between the nazion and the most prominent point of the lower jaw) to its width (the distance between the extreme points of the zygomatic bones) multiplied by 100 (Martin, 1928).

All the studied skulls on the superscript of the face were divided into 3 groups: Wide-faced (Eiren) (ind. <49.9), average face width (mezen) (ind. 50.0 - 54.9), narrow-faced (leptin) (ind.> 55.0).

To study the asymmetry of the facial skull and was used “fan method of morphometry” (Gayvoronsky, 2009). The proposed method allows us to estimate the asymmetry in different parts of the facial skull. All studied parameters were divided into three “fans” - “upper”, “lower”, “lateral”, outgoing from three standard points: Nazion (N is the point located on the nasal seam), subspinal (Ss is the point located under the front nasal spine), zygomaxillary (Zm - point located in the lower part of the jaw joint).

The digital data of our study were subjected to statistical processing, observing the general provisions for medical and biological research. The data were processed by a variation-statistical method using the Statistical application package (Statsoft, 1999) and Microsoft Excel Windows-7 (Borovikov, 2015).

RESULTS AND DISCUSSION

We have established that leptorrhines predominate in the total sample, mezorines are in second place in terms of frequency, and chamerins are in third place in frequency. Thus, it can be concluded that mesoproteins predominate in the shape of the facial skull, but in the shape of the leptorrhine nose (Table 1).

To characterize the facial skull and nasal region, 14 standard linear dimensions and 2 indices (upper facial and nasal) were included.

All studied parameters were divided into three "fans" - "upper", "lower" and "lateral", coming from the following standard points: nasion, subspinale, zygomaxillary (n is a point located on the nasaloneal suture, ss is a point, located under the anterior nasal spine, zm is the point located in the lower part of the zygomatic-jaw seam).

A comparative analysis of unpaired indicators by sex and depending on the width of the nose indicates the following:

1) The width of the nasal bones at the level of the nasal-frontal suture (n-fr).

This indicator varies, on average, from 9.2±0.8 mm for hamerins to 11.7±0.4 mm for leptorrhines in the female skull series and from 11.7±1.8 mm for hamerins to 13.1±0.5 mm for leptorrhines in the male series of skulls, with an average value in the total sample of 12.2±0.6 mm.

Table 1. Quantitative distribution of the studied group of skulls depending on the size of the nasal index.

No		The value of the index (in one)	Characteristics of the skulls in the total sample	
			Quantity (in one)	Quantity (in %)
1	Leptorrhines	<43.5-47.5	19	47.5
2	Mezorins	47.6-52.1	14	35.0
3	Chamerins	>52.2	7	17.5

Table 2. Statistical indicators of women with various forms of the external nose.

No	Investigated trait	Research side	Statistical indicators					
			Chamerins	Difference between states	Mezorins	Difference between states	Leptorrhines	Difference between states
1	n-zm	right	63.30±0.75	-0.90	66.07±0.96	0.14	72.70±0.98	5.01
		left	64.20±0.80		65.93±0.94		67.69±1.05	
2	n-fmt	right	51.85±0.80	0.35	53.25±0.69	0.04	53.48±0.48	0.08
		left	51.50±0.84		53.21±0.60		53.40±0.46	
3	n-ft	right	49.10±0.64	-0.05	48.86±0.52	-1.43	49.88±1.02	-0.86
		left	49.05±0.63		50.29±0.69		50.74±0.45	
4	n-ap. inf	right	46.27±0.67	-0.28	48.09±0.87	-0.37	48.81±0.73	-0.29
		left	46.55±0.68		48.46±0.79		49.10±0.69	
5	n-ap.lat	right	41.10±0.62	-0.05	42.94±0.69	-0.02	44.42±0.71	0.51
		left	41.15±0.60		42.96±0.62		43.91±0.69	
6	n-infr	right	39.80±0.80	-0.65	41.96±0.86	-0.10	43.15±0.77	-0.05
		left	40.45±0.83		42.06±0.83		43.20±0.83	
7	n-max width	right	24.45±1.08	-0.36	27.16±0.71	-0.77	27.36±0.65	0.35
		left	24.81±1.12		29.93±0.61		27.01±0.79	
8	n-da	right	14.95±0.61	-0.63	16.19±0.40	0.65	15.78±0.32	-0.06
		left	15.58±0.75		15.54±0.79		15.84±0.31	
9	n-min width	right	8.13±0.42	0.26	10.19±0.42	-0.05	9.69±0.33	0.61
		left	7.77±0.42		10.24±0.41		9.08±0.32	
10	n-fn seam	right	6.67±0.58	-0.01	7.61±0.56	0.05	7.67±0.25	-0.29
		left	6.68±0.59		7.56±0.58		7.96±0.33	

2) Nose length (n-rhin). The value of this non-standard indicator in mm varies, on average, from 23.1±0.7 mm for leptorrhines to 17.7±1.4 mm for chamerins in the men's skull series, with an average value of this indicator in the total sample of 21.0±0 , 7 mm and from 20.4±0.7 mm in leptorrhines to 19.8±0.9 mm in chamerins in the female skull series with an average value of this feature in the total sample of 20.3±0.9 mm.

3) The height of the pear-shaped hole (rliin-sp). This indicator varies across the width of the nose: from 36.4±0.8 mm in leptorrhines to 32.5±1.0 mm in chamerins in the male series of skulls, with an average value of this indicator in the total sample of 32.9±0.8 mm. The following signs on the characteristic of asymmetry of the facial skull of the “upper fan” were measured in pairs to the left and to the right.

Their dimensions in mm were arranged in descending order separately for the male and female series of skulls.

In the women's series, significant asymmetry in terms of the nasion-zygomaxillary indicator of the chamerins is left-sided, in the leptorrhines it is right-sided, while in the group of mezorins, the asymmetry is right-sided and insignificant. With regard to the asymmetry of the nasion-frontotemporal index, there is a weak right-sided asymmetry in chamerins and significant asymmetry in the group of meso and leptorrhines (table 2). The asymmetry of the nasion-nasomaxillary index varies from weak left-sided with chamerins to strong left-sided in the mezorin group, opposite to chemerins.

Of particular interest is the size of the nasion-front-molar-temporal in the male series, where the dimensions on the right vary, on average, from 55.3±1.4 mm for chamerins to 56.4±0.5 mm for leptorrhines, while the average sizes for mezorins make up 56.5±0.51mm.

Table 3. Statistical indicators of men with various forms of the external nose.

№ right/right	Investigated trait	Research side	Statistical indicators					
			Chamerins	Difference between states	Mezorins	Difference between states	Leptorrhines	Difference between states
1	n-zm	right	69.50±0.38	0.60	71.87±0.82	-0.31	67.48±0.67	-5.02
		left	69.40±0.21		72.88±0.86		72.50±0.72	
2	n-fmt	right	55.30±0.43	-0.60	56.51±0.51	-1.73	56.36±0.43	0.23
		left	55.90±0.41		58.24±0.78		56.13±0.45	
3	n-ft	right	51.92±0.95	0.12	53.59±0.54	-0.07	54.83±0.56	1.19
		left	51.80±0.86		53.66±0.47		52.84±0.58	
4	n-ap. inf	right	48.04±0.50	-0.76	49.80±0.75	-0.04	52.52±0.55	-1.45
		left	48.80±0.62		49.84±0.84		53.97±0.46	
5	n-ap.lat	right	43.50±0.40	0.28	45.25±0.64	-0.07	47.03±0.43	-0.08
		left	43.22±0.53		45.32±0.65		47Д2±0.46	
6	n-infr	right	42.20±1.06	-1.04	45.27±0.63	0.25	46.37±0.27	0.42
		left	43.24±0.61		45.02±0.61		45.95±0.37	
7	n-max width	right	31.50±0.35	5.90	27.78±0.68	-0.27	29.07±0.74	-0.46
		left	25.60±0.77		28.05±0.62		29.23±0.70	
8	n-da	right	17.30±0.83	-0.30	17.29±0.40	-0.08	17.74±0.37	0.25
		left	17.60±0.68		17.37±0.23		17.49±0.35	
9	n-min width	right	9.40±1.08	-0.08	10.18±0.49	-0.06	11.09±0.38	1.34
		left	9.48±0.98		10.24±0.45		9.75±0.34	
10	n-fn seam	right	7.94±1.08	-0.04	8.00±0.50	0.02	8.90±0.34	0.06
		left	7.98±1.11		7.88±0.46		8.84±0.31	

Similarly, the left dimensions: from 55.9±1.1 mm for chamerins to 56.1±0.5 mm for leptorrhines, with an average size of 58.2±1.8 mm.

Table 3 shows the dimensions of the facial skull in the shape of the nose in the men's series, asymmetry sizes are calculated according to the indicators of the “upper fan” from the nasion point (table 3).

From the data obtained, it follows that the most significant left-sided asymmetry is observed in terms of nazion-zygomaxillary in leptorrhines in the male skull series, and the most significant right-sided asymmetry is observed in terms of nazion-naxomaxillary in chamerins in the same group.

Further, a significant left-sided asymmetry can be noted in terms of the nazion-front-molar-temporal variable in the mezorins in the male series of skulls.

In terms of the nasion-frontotemporal and distance from the nasion point to the junction of the nasal bones, significant right-sided asymmetry is observed in the male skull series in leptorrhines and the distance from the point to the lowest point of the pear-shaped hole – significant left-sided asymmetry in leptho and chamerins in the same group.

In a comparative analysis of the female and male series of skulls, it can be noted that in terms of the nasion-zygomaxillary indicator, the leptorrhines in the female series have a significant right-sided asymmetry, while the leptorrhines in the men's series have significant left-sided asymmetry. In terms of the nasion-front-wheel-molar-temporal index, in the female series, there is a slight right-sided asymmetry in all three groups, while in the male series, for chamerins and mezorins, there is left-sided asymmetry and for leptorrhines, there is insignificant right-sided asymmetry.

In terms of the nasion-frontotemporal index, in the female series, there is significant left-sided asymmetry in meso- and leptorrhines, whereas in the men's series, in leptorrhines, there is significant right-sided asymmetry.

In terms of the indicator from the nazion point to the lowest point of the pear-shaped hole, there is left-sided asymmetry in the women's and masculine series, and this is slightly pronounced in the women's series, and significantly in the masculine series.

In terms of the nion-infraorbital indicator, wide-bearing men and women show significant left-sided asymmetry. In terms of the nasion-nasomaxillary indicator, a significant left-sided asym-

metry is observed in the female skull series with medium nose sizes, whereas in the male series, the left-sided asymmetry is negligible.

Wide-nosed men have a very significant right-sided asymmetry. Whereas, in the female skull series it is insignificant and left-sided. In terms of the distance from the nasion point to the junction of the nasal bones, narrow-pointed men and women show significant right-sided asymmetry.

The fact of asymmetry in the external structure of the face and body of man has been known since ancient times to artists and sculptors of the ancient world, and was used by them to impart expressiveness and spirituality to their works (Alekseyev and Alekseyeva, 1989).

All human asymmetries are divided into static (proportions, dimensions, weight, volume, etc.) and functional: motor (motor), sensory (sensitive) and, mental or sensual (Kibkalo, 2006).

Among the morphological asymmetries of the face, the deviation of the nose to the right is expressed in right-handers and to the left in left-handers; the right half of the face most people have more than the left half (Koff and Borod, 1981).

The data obtained indicate that in the female series, significant asymmetry is determined by the nazion-zygomaxillary indicator for left-sided chamerins, left-sided in leptorrhines, while asymmetry in the mezorin group is right and minor.

According to I.V.Gayvoronsky and S.Y.Baybakov (2008) points of the infraorbital and zygomaxillary are the attachment points of the mimic muscles. Consequently, the difference in size for these parameters is due to the functional asymmetry of the mimic muscles along the “side fan” asymmetry is almost negligible, both left and right (Gayvoronsky and Baybakov, 2008).

When analyzing the data obtained, a steady trend towards left-sided asymmetry can be noted in almost all indicators of the “side fan” in the men's series. The only exception is the distance from the point of the zygomaxillary to the lowest point of the pear-shaped hole, along which the right-sided asymmetry is noted in the men's series.

According to Y.I.Dubovik (2009), the asymmetry of the dimensions of the “side fan” is influenced by the mimic muscles of the muscle. Thus, the tone of the facial muscles raising the upper lip, zygomatic, nasal and cheek muscles causes a change in the shape and size of the bony structures of the facial skull (Dubovik, 2009).

CONCLUSIONS

1. Among the studied skulls, mesoprozeps predominate in the shape of the facial skull, and not the nose form leptorrhines.
2. In the female series, significant asymmetry is determined by the nasion-zygomaxillary index in skulls with a wide nose with left-sided, in skulls with a long nose-right-sided, whereas in the group of skulls with a nose-like asymmetry a slight right.
3. A steady trend towards left-sided asymmetry in almost all indicators of the “side fan” in the men's series. The only exception is the distance from the point of the zygomaxillary to the lowest point of the pear-shaped hole, along which the right-sided asymmetry is noted in the men's series.

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Burunun formasından asılı olaraq insanın kəlləsinin ölçülərinin müqayisəli xüsusiyyətləri

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Azərbaycan Tibb Universitetinin İnsan anatomiyası və tibbi terminologiyası kafedrası

Üz kəlləsinin kraniometrik göstəriciləri Azərbaycan Tibb Universitetinin insan anatomiyası və tibbi terminologiya kafedrasının əsas muzeyinin kranioloji kolleksiyasından xüsusi seçilmiş 40 insan kəlləsi üzərində tədqiq edilmişdir. Müəyyən edilmişdir ki, öyrənilən kəllələr içərisində üz kəlləsinin formasına görə üzlülər, burunun formasına görə ensiz burunlar üstünlük təşkil edir. Qadın kəllələri içərisində nasion-ziqomaksilyar məsafənin göstəricisinə burunun enli formalarında sol tərəfli, uzun formalarında sağ tərəfli, orta formalarında zəif sağ tərəfli asimmetriya müəyyən edilmişdir. Kişi kəllələrində "Yan yelpik"in bütün göstəricilərində sol asimmetriyaya meyllilik aşkar edilmişdir. Ancaq ziqomaksilyar nöqtədən armudu dəliyin aşağı nöqtəsi arasındakı məsafədə sağ tərəfli asimmetriya müşahidə edilmişdir.

Açar sözlər: *Asimmetriya, üz kəlləsi, kraneometryanın yelpik üsulu, üzün yuxarı indeksi*

Сравнительная характеристика размеров лицевого черепа у взросло человека в зависимости от формы носа

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Краниометрические показатели лицевого черепа были изучены на 90 специально подобранных черепах людей из краниологической коллекции фундаментального музея кафедры анатомии человека Азербайджанского медицинского университета. Установлено, что среди изученных черепов по форме лицевого черепа преобладают мезопрозепы, а по форме носа лепторины. В женской серии определяется значительная асимметрия по показателю назион-зигомаксилляре: у черепов широким с носом - левосторонняя, у черепов с длинным носом - правосторонняя, тогда как в группе черепов со средним носом - асимметрия незначительная правосторонняя. Устойчивая тенденция к левосторонней асимметрии отмечена практически по всем показателям «бокового веера» в мужской серии. Исключение составляют расстояние от точки зигомаксилляре до наиболее нижней точки грушевидного отверстия, по которой отмечается правосторонняя асимметрия в мужской серии.

Ключевые слова: *Асимметрия, лицевой череп, веерный метод морфометрии, верхний индекс лица*